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Treatment of Difficult and Involved Colles' Fractures

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SUMMARY

Of 105 cases of Colles' fracture, 86 were treated by closed reduction and plaster immobilization alone; 19 cases in which the fractures were more severe were treated by fixed skeletal traction using an external skeletal traction splint.

Despite the greater severity of the lesions, the end results, both anatomic and functional, were generally better in those cases in which skeletal traction was used than in those treated by closed reduction.

FRACTURES of the distal end of the radius which cause comminution and impaction of the fragment of the radius are the only true Colles' fractures.[5] As cancellous bone must be present for this to occur, true Colles' fracture never occurs in persons under 20 years of age. In most cases in which persons in the second and third decades of life receive a fracture in a fall on an outstretched hand, the break is in the carpal scaphoid rather than in the radius at the wrist. Most Colles' fractures occur in persons over 40 years of age; the incidence is higher in persons over 50 years of age.

In a Colles' fracture there must be an element of impaction or compression of fragile cancellous bone. After the impaction is broken up and the fragments are pulled out into proper alignment, a dead space remains (Figure 1), caused by the compression of the elements of cancellous bone in that area. This dead space must fill in with blood clot and new bone before healing of the fracture occurs. If the impaction is severe or comminution exists, it becomes exceedingly difficult to maintain length and alignment of the radius while the dead space is filling in with new bone. For this reason, in many cases Colles' fracture is complicated by loss of position following reduction, shortening of the radius, a radial shift of the carpus, and distortion in the normal relationship of the radius and ulna in the distal radio-ulnar joint. This fact accounts for the permanent residual deformity and disability so common after a severe Colles' fracture; the patients have limited mobility in the wrist joint, and almost all of them have pain at the distal radio-ulnar joint. Several reconstructive surgical procedures have been developed to overcome this disability. Campbell[4] advised osteotomy of the radius with a bone graft inserted to restore length and proper alignment of the radius

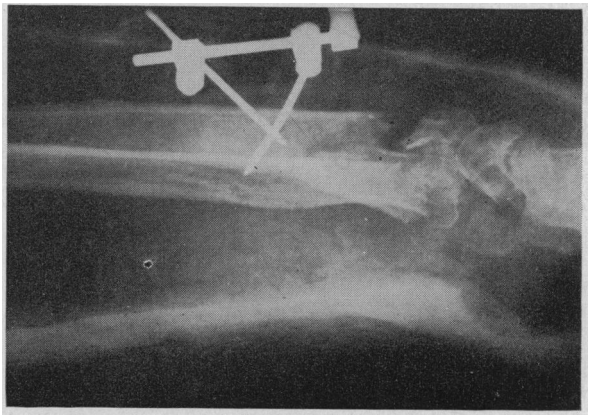

Figure 1.—Severe Colles' fracture in traction. Note area of dead space which must fill in with new bone to maintain length.

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with the carpus. Darrach[6] advised resection of the distal end of the ulna so as to allow for restoration of normal pronation and supination, and to obviate pain in the distal radio-ulnar joint. The authors felt that if length and alignment of the radius could be maintained by fixed skeletal traction while the dead space was being obliterated with new bone formation, the development of deformity could be prevented and the necessity for reconstructive surgical procedure avoided.

One hundred thirty-nine patients with Colles' fracture were treated at the San Francisco Hospital; 105 were followed up for at least six months, and the end results were studied and evaluated. In the other 34 cases follow-up was inadequate.

Closed reduction with plaster immobilization was carried out in 86 cases. The number of patients in each age group, by decades, was as follows: Third decade, 5; fourth, 14; fifth, 15; sixth, 21; seventh, 10; eighth, 17; ninth, 5. In the majority of cases sodium pentothal was used for anesthesia during reduction and a plaster of paris cast extending from the proximal palmar crease to above the elbow was applied for immobilization. The forearm was held in moderate pronation at about 15 to 20 degrees of flexion and 20 to 25 degrees of ulnar deviation. When the reduction was accomplished and the cast applied, the forearm was held in a position of pronation before the wrist was flexed and placed in ulnar deviation. This is an important point because of the fact that the procedure placed the hand in such a position that full finger motion was made possible.

The detail of moulding the plaster to hold the carpus tightly against the ulna is important. The cast must be cut back far enough into the palm to allow for 90 degrees of motion in the metacarpophalangeal joints. If this much finger motion is possible, there is no chance for fixation of the flexor and extensor tendons at the site of fracture. As a consequence, there is no difficulty in restoring wrist movement even though a fracture has been held for as long as eight to 12 weeks in plaster.

In evaluating anatomic and functional end results, the following system of grading was adopted: 0 for failure; 1 for 25 per cent of normal; 2 for 50 per cent of normal; 3 for 75 per cent of normal, and 4 for normal.

Anatomic results were as follows: in 26 cases, 0; in two cases, 1; in 11 cases, 2; in 26 cases, 3; in 21 cases, 4.

Functional results: in one case, 1; in seven cases, 2; in 37 cases, 3; in 41 cases, 4. Most of these patients had a satisfactory wrist joint even though some of the anatomical position was lost due to resorption and shortening in plaster.

Figure 2.—End result following resection of the distal end of the ulna according to the method of Darrach. The distal radio-ulnar joint is eliminated and pronation and supination are restored.

Figure 3.—Substitution of pseudoarthrosis in the shaft of the ulna to compensate for the loss of movement in the distal radio-ulnar joint. Main indication where shortening of the radius is not excessive.

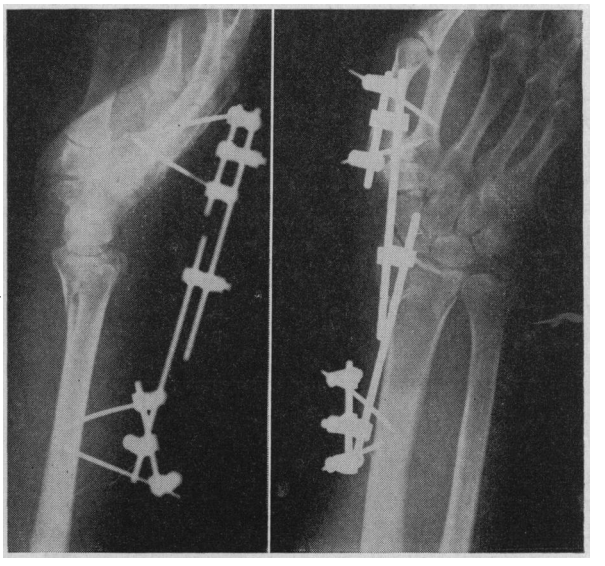

Figure 4.—First half pin unit placed through the shaft of the second metacarpal, and the second half pin unit placed in the shaft of the radius proximal to the fracture. The closed reduction is maintained by the external fixation bar.

Figure 5.—Case 1. Note severity of comminution of the radius with compression of the cancellous bone. Dead space created.

Figure 6.—Case 1. End result, one year, shows healing with fair preservation of length. Dorsal tilt, distal end of the radius 20 degrees. Distortion of the distal radio-ulnar joint caused by shortening of the radius. Anatomical result considered 50 per cent of normal. Functional result is excellent. Three years later the patient was doing heavy manual labor.

Figure 7.—*(Left):* Case 2. Note, severe comminution, shortening, and radial shift, but no fracture of the ulna. *(Right):* Lateral projection, showing a free segment of radius lying over the metacarpal shaft in subcutaneous region.

In three of the cases in which closed reduction was carried out there was so much deformity that reconstructive surgical procedure was necessary to provide a satisfactory wrist. Two of the patients had resection of the distal end of the ulna (Figure 2). The third had a cuff resection of a portion of the ulna, an operation described by Sauve and Kapandji[12] (Figure 3). This latter procedure is a very useful one if the degree of shortening of the radial fragment is not excessive, because it does eliminate the factor of pain in the distal radio-ulnar joint without causing cosmetic deformity of the wrist joint proper.

DIFFICULT AND INVOLVED COLLES' FRACTURES

In 19 cases there was extensive comminution of the distal end of the radius. From previous experience it was felt that any attempt to hold these fractures by closed means alone could only result in severe, crippling deformities that would necessitate major surgical intervention later. Therefore the patients were operated upon shortly after injury and a fixed skeletal traction apparatus was applied. The apparatus used was made up of the dental elements of an external Roger Anderson[1] fixation splint (Figure 4). At first the method was used only in extreme cases, but the results obtained were so satisfactory that the number of patients so treated was increased as time went on. The authors wish to emphasize the need for traction in all cases of comminuted Smith fracture (reverse Colles').

The operative procedure demands the same care and preparation as that required for any major orthopedic operation. The splint is applied with strict aseptic precautions under general anesthesia in an operating room. Two pins are obliquely placed through the shaft of the second metacarpal, and two pins are placed obliquely through the bare area on the shaft of the radius proximal to the site of fracture. The apparatus is adjusted and a closed reduction done. The apparatus is tightened while the reduction is being maintained manually. X-ray films are obtained immediately and if any adjustment of position of the fracture fragments is necessary it is done at that time. Adequate length in the anteroposterior projection is mandatory. In the lateral projection, a vertical position of the articular surface of the radius is accepted because it has been found impossible to rotate a mass of comminuted fragments of bone into a position of volar angulation. The pinholes are carefully dressed and the whole apparatus covered with sterile sheet wadding. Because there is movement of the skin near the proximal pin, a plaster covering extending above the elbow is applied in order to obviate irritation at that site and the possibility of pin tract infection.

At the end of three weeks the original cast is removed and replaced by a forearm covering of plaster. This is worn until such time as x-ray studies show evidence of adequate bone union at the site of fracture. If the union is precarious, the splint should be left in place for as long as eight to ten weeks' time. Premature removal of the splint can result in prompt loss of position of fragments. Full function of the hand, elbow, and shoulder is maintained at all times.

Despite the severity of the 19 cases treated by fixed skeletal traction, the results, anatomic and functional, were better in this group than they were in the group in which closed reduction alone was used.

The grades for anatomic results were: in two cases, 2; in 13 cases, 3; in four cases, 4. Functional results were: in nine cases, 3; in ten cases, 4.

Physiological age and economic need are the main factors taken into consideration in choosing patients to be treated by this method. The main aim has been to prevent deformity in patients who have a moderate life expectancy and who must return to some form of productive work. Sixteen of the 19 patients were less than 60 years of age.

CASE REPORTS

CASE 1: The patient, a man 60 years of age, had sustained a severe comminuted Colles' fracture of the left wrist (Figure 5). Two days later closed reduction was carried out and a fixed skeletal splint applied (Figure 1). A long arm cast was used for three weeks and a short arm cast for another month. The fixation pins then were removed and a short arm cast was continued for an additional four weeks. The end result is shown in Figure 6.

CASE 2: A woman 27 years of age entered San Francisco Hospital with multiple fractures received in a fall from a considerable height. The distal shaft of the left radius was severely comminuted (Figure 7, left). A loose fragment of the radius which measured about 2 cm. in length was found lying subcutaneously near the base of the metacarpal bones (Figure 7, right). An external skeletal splint was applied

Figure 8.—Case 2. End result, seven months. Solid healing of fracture. Note, slight radial shift persisting. Anatomical result rated 75 per cent of normal. Functional result excellent except for loss of 50 per cent supination.

and a closed reduction of a fracture of the wrist was carried out. The free fragment of radius was excised. Skeletal traction was continued for seven weeks and a short arm plaster cast was used for another six weeks. The end result, seven months after injury, is shown in Figure 8.

* * *

CASE 3: A 49-year-old man had a severe comminuted fracture of the distal end of the left radius (Figure 9). An external skeletal fixation splint was applied on the date of injury in the usual manner. This was worn for six weeks, and a short arm plaster cast was worn for an additional four weeks. The patient was able to return to his regular work as a fireman, without disability, three and a half months after the injury occurred. The end result is shown in Figure 10.

* * *

CASE 4: A 62-year-old housewife had an extremely severe comminuted fracture of the radius and the ulna (Figure 11). There was an excessive amount of soft tissue swelling. An attempt at closed reduction was made and the arm was elevated until the swelling subsided. As it was felt that satisfactory position could not be maintained, an external skeletal fixation splint was applied and the fracture of the radius was

Figure 9.—Case 3. Note, severe comminution of the radius with shortening and carpal shift. No fracture of the ulna.

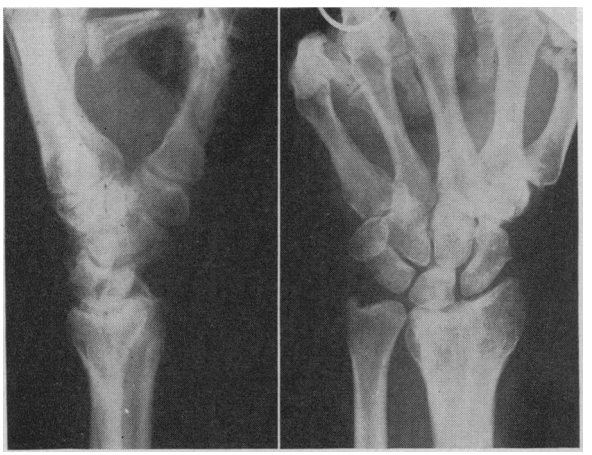

Figure 10.—Case 3. End result, nine months. Anterior-posterior, excellent alignment. Almost normal relationship of the distal radio-ulnar joint. Lateral projection, slight dorsal tilt of the articular surface of the radius. Full work capacity as a fireman.

Figure 11.—Case 4. Note, extreme comminution of both the radius and ulna: A completely unstable fracture.

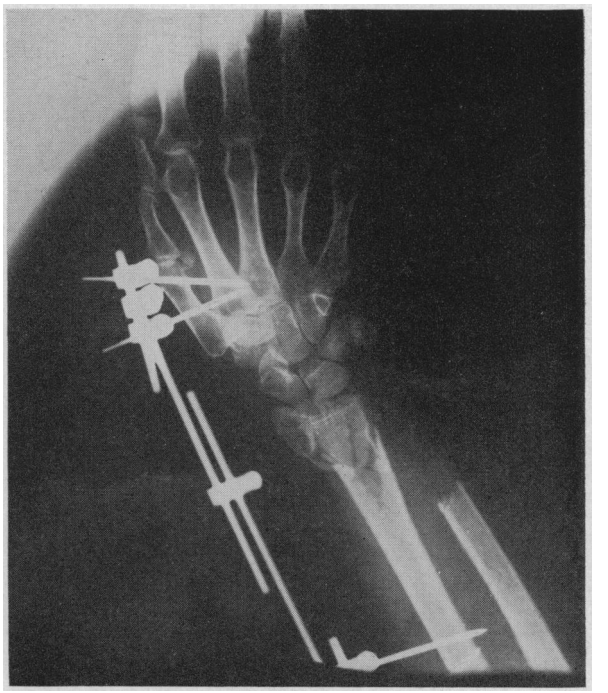

Figure 12.—Case 4. Primary resection of the distal end of the ulna.

Figure 13.—End result, nine months later. Excellent alignment and length of the radius. Normal function except for a 25 per cent loss of the ability to grip.

reduced by closed means. The alignment of the radius then was considered quite satisfactory. The fragment of the ulna could not be kept in adequate position and, furthermore, trouble was anticipated because of gross disturbance at the distal radio-ulnar joint. Therefore, primary resection of the fragment of the ulna was done (Figure 12) two weeks after the skeletal splint was applied. The operative wound healed without incident. The skeletal traction was maintained for another two months, and a short forearm cast was worn for an additional four weeks. When last observed, seven months later, the patient had normal range of motion in the wrist and, except for slight weakness in gripping power, there was no residual disability (Figure 13).

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